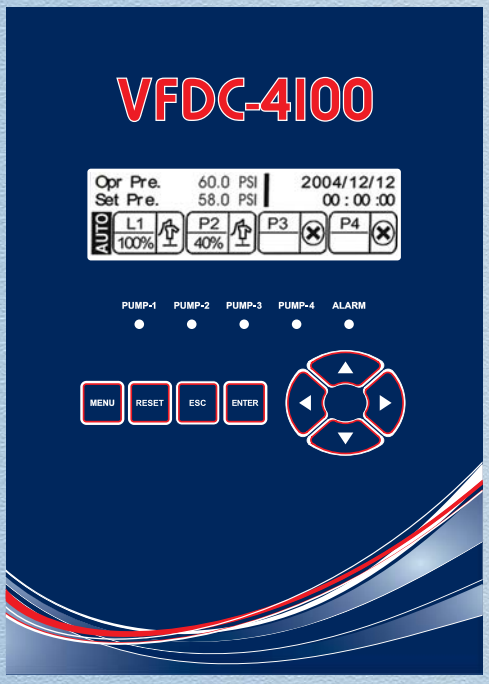
VFDC-4100 Controller

User Manual



This manual explains the features and operations of the VFDC-4100 controller which is specifically designed for Pressure Booster Pump Systems. The VFDC-4100 controller is capable of maintaining a constant discharge pressure by adjusting the speed of up to 4 Variable Frequency Drives (VFDs), one VFD and up to 3 across the line (ATL) starters, or one Jockey pump and up to 3 main pumps.

⚠ WARNINGS

Failure to read and understand the information provided in this manual may result in personal injury or death, damage to the product or product failure. Please read each section in its entirety and be sure you understand the information provided in the section and related sections before attempting any of the procedures or operations given.

Failure to follow these precautions could result in serious injury or death.
Keep these instructions with warranty after installation. This product must be installed in accordance with National Electrical Code, ANSI/NFPA 70 so as to prevent moisture from entering or accumulating within the controller housing.

⚠WARNING

ELECTRICAL SHOCK HAZARD

Disconnect power before installing or servicing this product.
A qualified service person must install and service this product according to applicable electrical codes and electrical schematics.

- Do not install in area with: excessive or conductive dust, corrosive or flammable gas, moisture or rain, excessive heat, regular impact shocks or excessive vibration.
- Do not place in water or let water leak onto the controller.
- Do not allow debris to fall inside the unit during installation.
- Double-check all the wiring before turning on the power supply.
- Do not touch live wires.
- Stay as far as possible from high-voltage cables and power equipment.
- Leave a minimum of 10 mm space for ventilation between the top and bottom edges of the controller and enclosure walls.

⚠WARNING

EXPLOSION OR FIRE HAZARD

Do not use this product with flammable liquids. Do not install in hazardous locations as defined by National Electrical Code, ANSI/NFPA 70.

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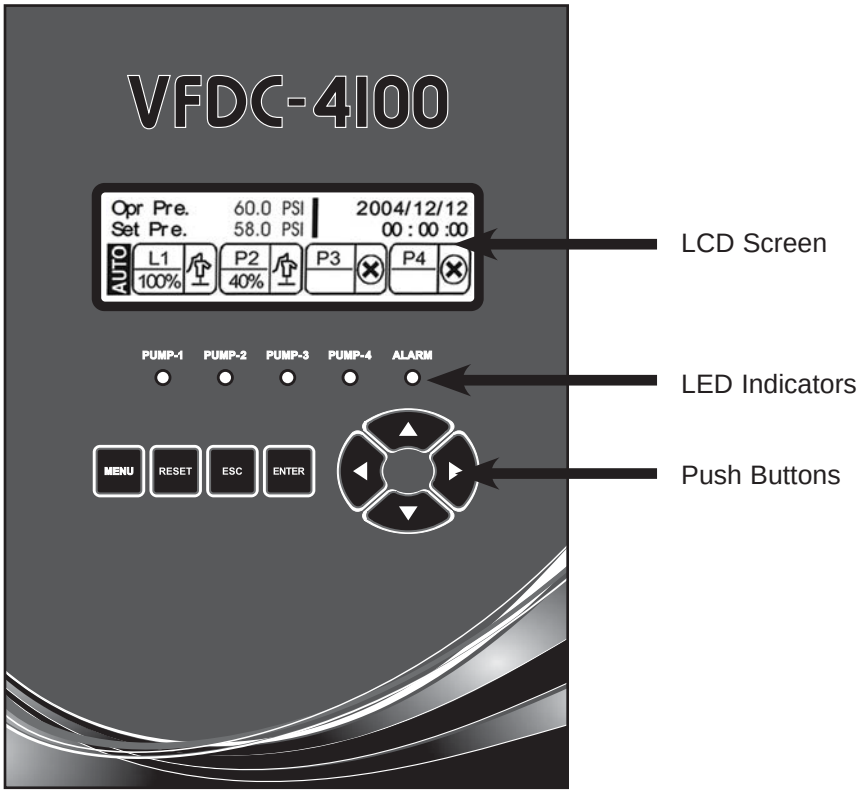
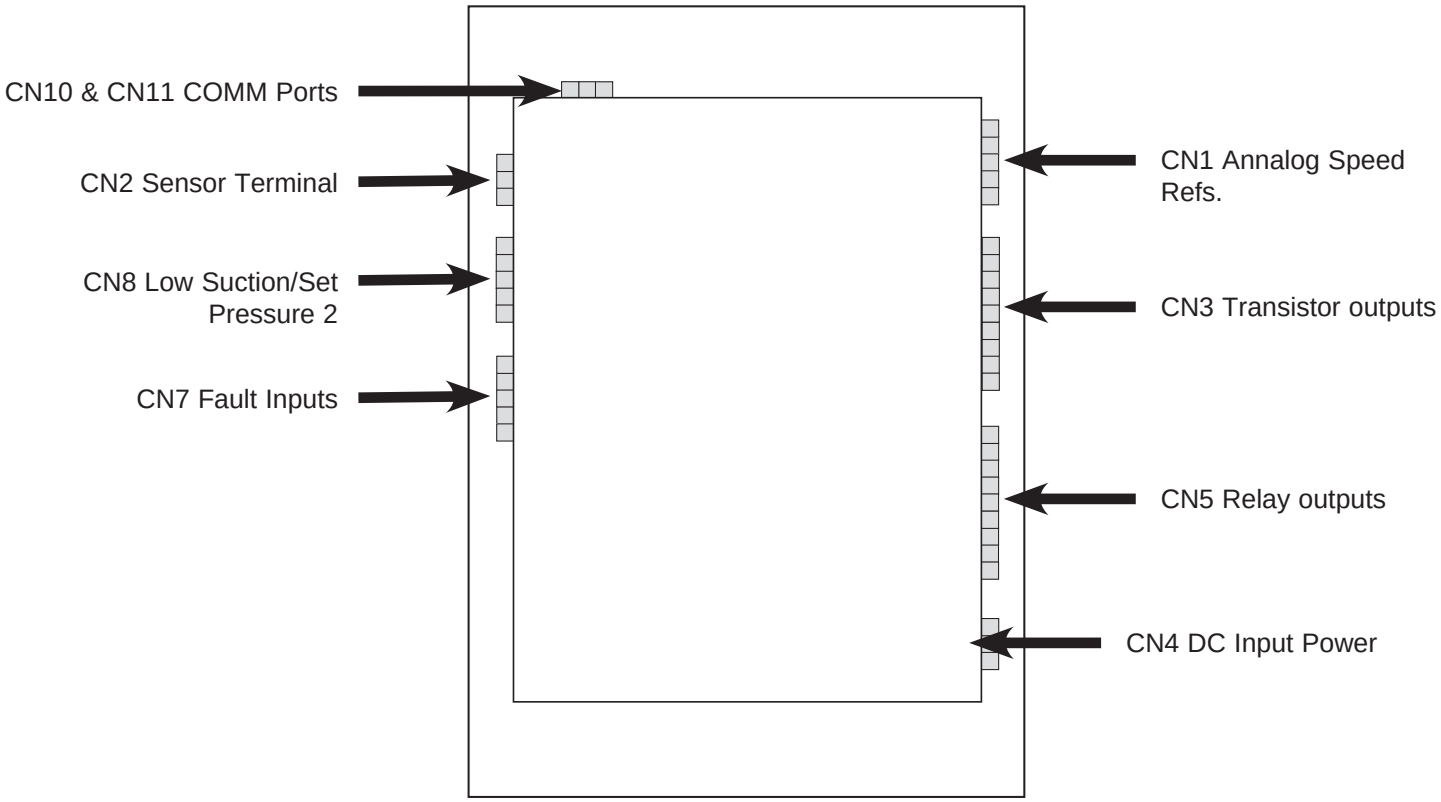
1.1 Controller Description

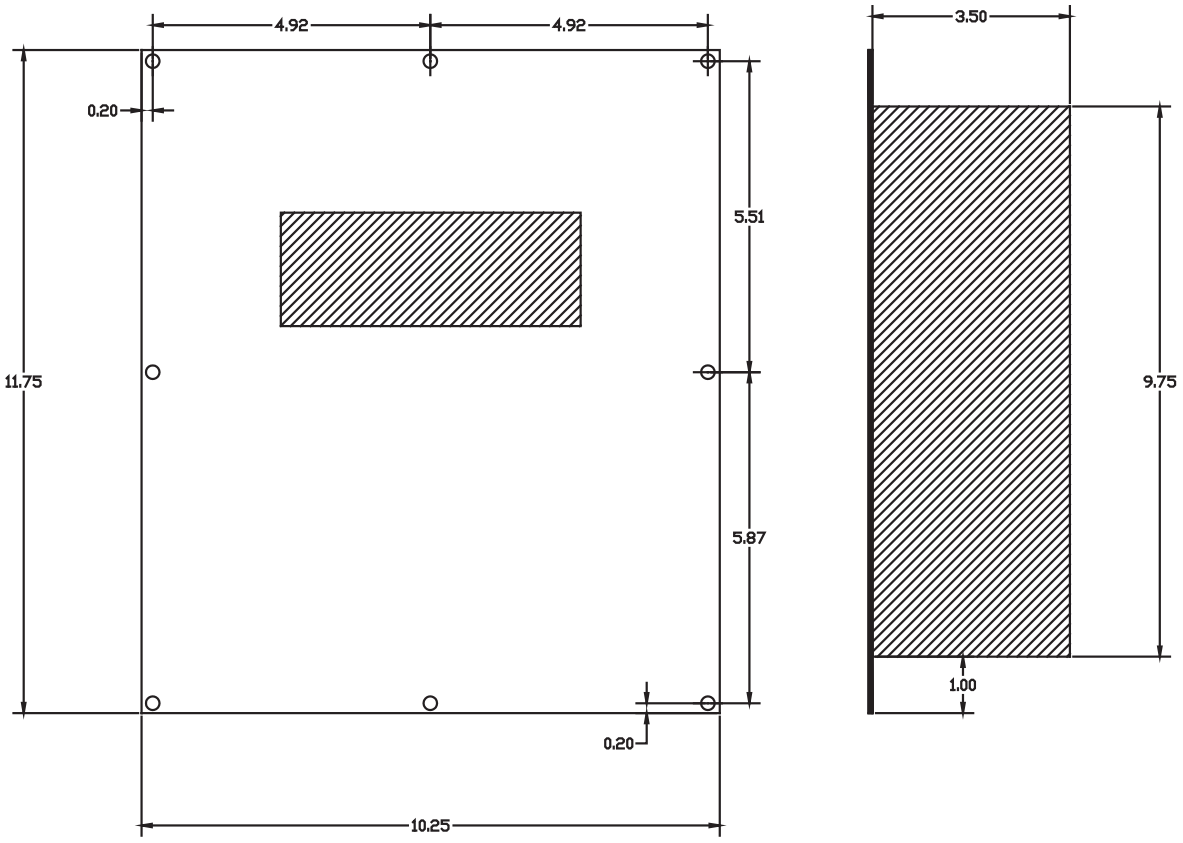
<Front View>



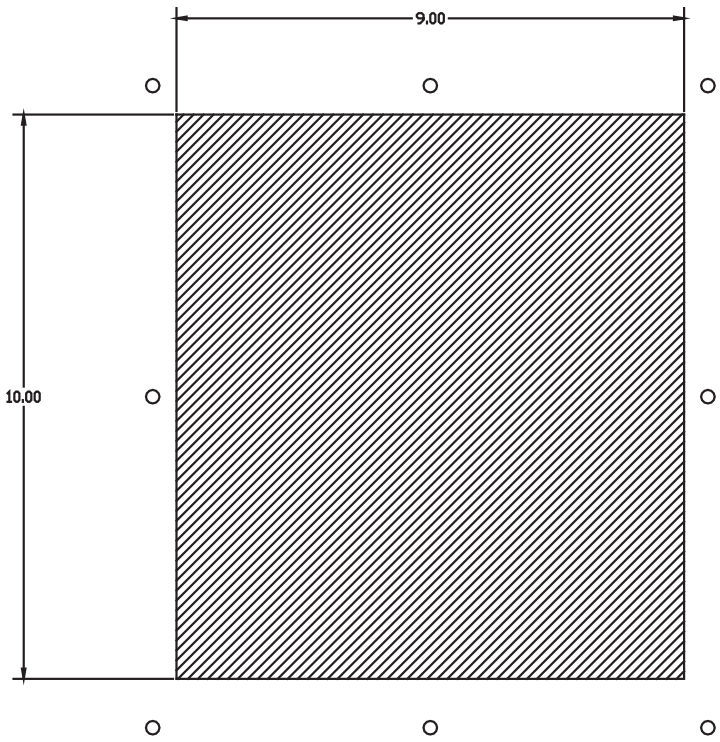
<Rear View>



1.2 Controller Outline Dimensions in inches.



Controller Outline Dimensions (In Inches)



Panel cutout dimmensions. (In Inches)
(Use the controller to line up the 8 screw holes)

Chapter 2

2.1 Description of Functions

LCD Display
The LCD Display is a user friendly operator interface with 240 x 64 pixels resolution; it allows the user to quickly view the system status and log.

Multiple Pumps Parallel Operation
The controller is able to control up to four (4) pumps utilizing all VFD's, or one VFD with up to 3 ATL (across the line) starters for the lag pumps.

Lead/Lag Operation
A fully automatic lead/lag operation based on the variation of the system discharge flow allows you to significantly reduce your energy cost and consistently maintain the system pressure. While the lead pump is operating, the system will sequentially start and stop lag pump(s) based on variation of the system pressure.

Across The Line (ATL) Pump Operation
When enabled and utilized, this function allows for multiple pumps to be controlled in a true PID pressure control system, while only needing one VFD. When the output of the lead pump (VFD) is at 100%, the controller changes that pump over to direct (ATL) operation and switches on the first lag pump using the VFD. In the same way, lag pump 2 and 3 can be added as needed for heavy flow conditions. The pump being controlled by the VFD will always be varying its speed as needed to maintain the set pressure.

Automatic Re-Start
Should the system shutdown by a sudden power loss, it will automatically restart when the power is restored. No manual reset is required. The system automatically returns to the running condition programmed and stored in the system memory.

Lead Pump Alternation
When selected as set time based, the alternation will occur when the total operating time of the lead pump reaches to the alternation time; the system automatically selects the next pump in sequence to be the lead pump. This function is designed to reduce the system life cycle cost. The system make all pump operate for equal period of time as to prevent the over-use of a particular pump resulting in high parts wear of the pump. The alternation may also be cycle based rather than time based.

Faulty Pump(s) Skip Function
The system automatically skips any pump sending a fault signal to the controller, and immediately changes the operating sequence to the functioning pumps. The faulty VFD/Pump will continue to report its fault until maintenance personnel can diagnose and repair the fault condition. A fault can be any of the following: VFD fault, starter overload trip (when using starters) or HAND/OFF/AUTP (HOA) selector switch is not in the AUTO position.

Dry Run Prevention
The system automatically stops the running pump(s) upon the detecting a Low pressure signal (Low Water). This function prevents the pump(s) from dry running that may result in damage to the pump(s).

Program
Used to program the set pressure to change based on a time/day/month basis.

Dual Set Pressures
An additional SET PRESSURE is available in the PRESSURE menu and can become the active set pressure by activating input 018 on CN8. This function can be useful for systems with large fluctuations in suction pressure or large variations in demand flow.

Alarm Display and Logging
The system displays alarm conditions on the LCD monitor, and records the condition in a log that is date and timed stamped.

Operating Data Display and Storage
The semi-permanent operating data recording and storage for each pump allows efficient pump maintenance.

Freeze Prevention
When this function is enabled the lead pump will automatically start at the VFD minimum output for 30 seconds and then shift to the next pump when the temperature is under 32 deg. This will occur when all pumps are stopped for more than 30 seconds at the same time.

Idle Prevention
If the lead pump does not run for the set time, corrosion of some parts may occur. In order to prevent this, the system will automatically run the lead pump at the minimum operating speed for 60 seconds and then starts the next pump in sequence. The same process will be repeated if the succeeding lead pump does not run during the set time.

Password
If the password function is enabled, a pop-up window will appear when you press the MENU button. You must enter your password to access the setup screens. This is to prevent access to the input values by an unauthorized person. You can change or disable the user password if you wish, however once enabled you must remember the value to gain access to the setup menu.

Communication
It is possible to monitor the system remotely when connected via the RS-232 port. See page 24 for details.

PID Control
The microprocessor based controller is programmed to perform adjustable Proportional, Integral and Derivative control to provide consistent and reliable pressure control.

LCD Screen Saver
The back light of the LCD display is programmed to automatically fade out if the keypad is not used for a set time. This function allows for maximum life span of the LCD monitor. This function can be disabled if desired.

Jockey Pump Function
The role of the Jockey pump is to maintain constant pressure during low flow conditions. When utilized, the jockey pump is typically much smaller than the main pumps and is well suited to handle variations in flow at a low flow rate. When flow demand exceeds the capacity of the Jockey pump and the main pumps are called to run, the Jockey will turn off after a programmable delay time, minimizing wear on the small pump.

Pre-Charge Function
In systems that drain out when not running, the pre-charge function allows for filling the piping system without causing damage. This function allows for the lead pump to run at a low preset speed for a preset time prior to switching over to full automatic operation. This greatly reduces water hammer to the piping system.

2.2 Security

The security system is designed to prevent access by unauthorized persons to the setup menu without entering a user password. If this function is turned on in the protect menu you will be required to enter the password to gain access to the setup screens. When you press the [Menu] button, the password pop-up window will appear. You must enter your user password to access the setup menu screens.

Set the password in the password function under the protect menu item by using the up/down & right/left key and press the enter button. The password must consist of 4 numbers.

After entering the password, and exiting the setup menu, access to the setup screens will be locked. The password will then need to be re-entered to access the setup screens.

2.3 Default Values

Menus	Setup Menus	Default	Input Range
DATE TIME	YEAR	2004	0000 ~ 9999
	MONTH	1	1 ~ 12
	DATE	1	1 ~ 31
	WEEKDAY	0	MONDAY ~ SUNDAY
	HOUR	0	0 ~ 23
	MINUTE	0	0 ~ 59
	SECOND	0	0 ~ 59
PUMP SET UP	LEAD PUMP	PUMP 1	1 ~ 4
	PUMP 1	USED	USED, NOT USED, JOCKEY
	PUMP 2	USED	USED, NOT USED
	PUMP 3	NOT USED	USED, NOT USED
	PUMP 4	NOT USED	USED, NOT USED
PRESSURE SET UP	SET PRESSURE	60 PSI	2 PSI ~ 650 PSI
	SET PRESSURE 2	60 PSI	2 PSI ~ 650 PSI
	HIGH PRESSURE LIMIT	95 PSI	3 PSI ~ 719 PSI
	LOW PRESSURE LIMIT	15 PSI	1 PSI ~ 649 PSI
	START LEAD PRESSURE	-3 PSI	-65 PSI ~ 65 PSI
	START LAG PRESSURE	-7 PSI	-65 PSI ~ 65 PSI
	STOP LAG PRESSURE	3 PSI	-0 PSI ~ 65 PSI
CONTROL SET UP	P VALUE	60	0 ~ 200
	I VALUE	30	0 ~ 200
	D VALUE	1	0 ~ 200
	CYCLE TIME	120 Msec.	50 ~ 999 M.SEC.
	ALTERNATION	24 HOURS	0 ~ 999 HOURS
	FRICTION	0.0 PSI	0 ~ 650 PSI
	RUN DELAY	1 SECONDS	0 ~ 10 SECONDS
	STOP DELAY	1 SECONDS	0 ~ 999 SECONDS
	JOCKEY STOP DELAY	5 SECONDS	0 ~ 999 SECONDS
	OPERATION TYPE	VFD	VFD, 1VFD+ATL
	LOW SUCTION TMR	30 SECONDS	10 ~ 999 SECONDS
	LOW SUCTION RST	AUTO	AUTO, MANUAL
	LOW SUCTION RST TMR	30 SECONDS	10 ~ 9999 SECONDS (2.78 HOURS)
	LOW PRESSURE STOP TIME	10 SECONDS	10 ~ 999 SECONDS
	INITIALIZE		YES, NO
SENSOR SET UP	SENSOR VALUE	200 PSI	29 PSI ~ 720 PSI
	SENSOR OFFSET	0 PSI	-72 PSI ~ 72 PSI
VFD	VFD STOP TIME	30 SECONDS	0 ~ 60 SECONDS
	VFD MINIMUM RATE	40%	10 ~ 90 % (of VFD DISP. TYPE)
	VFD STOP RATE	60%	20 ~ 90 (of VDF DISP. TYPE)
	VFD DISP. TYPE	100%	100%, 60Hz, 50Hz
	VFD AUTO RESET	5	0 ~ 20
	PIPE FILL	OFF	ON, OFF
	PIPE FULL RATE	45%	10 ~ 90% of VFD DISP. TYPE or VFD
	PIPE FILL TIMER	30 SECONDS	5 ~ 600 SECONDS

2.3 Default Values con't.

Menus	Setup Menus	Default	Input Range
PROTECT	IDLE PREVENTION	NOT USED	USED, NOT USED
	FREEZE PREVENTION	NOT USED	USED, NOT USED
	PASSWORD USE	NOT USED	USED, NOT USED
	PASSWORD	1234	0000 ~ 9999
SYSTEM	RETURN TO MAIN SCREEN	120 SECONDS	10 ~ 300 SECONDS
	LCD BACK LIGHT TIME	120 SECONDS	10 ~ 998 SECONDS (999 TO DISABLE)
	DATA LOG	60 SECONDS	0 ~ 999 SECONDS (16.65 MIN)
	TEST CODE	0	0 ~ 9999 (NOT USED)
	RELAY OUTPUT 1	STOP	AVAILABLE SETTINGS FOR OUTPUTS:
	RELAY OUTPUT 2	RUNNING	NOT USED, PUMPS STOPPED, PUMPING,
	RELAY OUTPUT 3	ALARM	GENERAL ALARM, LOW SUCTION, P1-P4
	RELAY OUTPUT 4	NOT USED	VFD RUN, P1-P4 ALT RUN, BUZZER,
	RELAY OUTPUT 5	NOT USED	LOW PRESSURE, HIGH PRESSURE,
	DIGITAL OUTPUT 6~13	NOT USED	VFD1-4 FLT/HOA, SENSOR FAULT
	LANGUAGE	ENGLISH	ENGLISH, ESPANOL
	PRESSURE UNIT	PSI	PSI, BAR
PROGRAM	SCHEDULE OPERATION	NOT USED	NOT USED, TIMELY, WEEKLY, MONTHLY
	00:00:00~00:00:00	NOT USED	0 PSI ~ 650 PSI
	TUESDAY	NOT USED	0 PSI ~ 650 PSI
	FEBRUARY	NOT USED	0 PSI ~ 650 PSI
COMM SET	RS232 TYPE	NOT USED	NOT USED, REMOTE
	BAUDRATE (232)	9600 bps	2400, 4800, 9600, 14400, 19200 38400, 57600, 76800, 115200
	RS485 TYPE	NOT USED	NOT USED, REMOTE
	BAUDRATE (485)	9600 bps	2400, 4800, 9600, 14400, 19200
	ADDRESS	0	0 ~ 31
	CODE	0	0 ~ 999
ALARM DATA	32 MOST RECONT ALARMS SAVED		SEE CHAPTER 6
OPERA DA	OPERATION DATA SELECTION	RUN LOG	RUN LOG, PUMP RUN TIMES Total 2000 lines of data saved. (Refer to Chapter 6)

2.4 Function Keys & Icon Description

2.4.1 Function Description

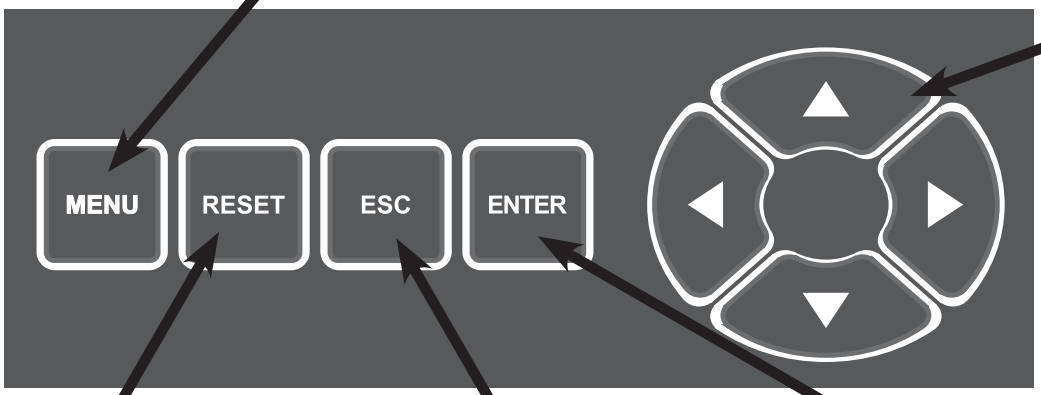
LCD Screen/LED Indicators/Keypad

1. **LCD:** Displays on the screen the operating status and setting.
2. **LED:** Displays the operation, alarm, operating pump, etc.
   Four PUMP LED displays the operation of each pump.
   LED Off: PUMP stopped
   LED On: PUMP running

3. **Function Keys**

MENU
Used to access the main setup screen. System may ask for a password if enabled.

Navigation Buttons



RESET
Used to clear faul codes after the fault condition is removed. (Some Faults may require you to cycle power.)

ESC
Press to move up in the menu structure or cancel an entry without saving.

ENTER
Press to accept a value or navigate down within a menu item.

2.4.2 Description of Icon

"Pump Setting" - "Pump 1 ~ 4"
Set to "USED" when the pump is available for use.

"Pump Setting" - "Pump 1"
When you set "Jockey Pump"

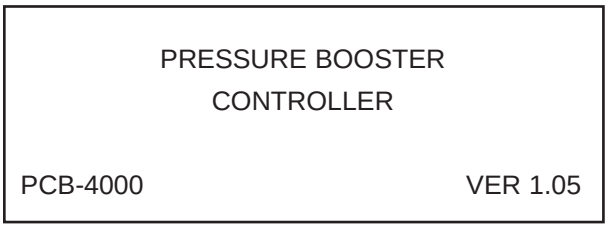
"Pump Setting" - "Pump 1 ~ 4"
Set to "NOT USED" when the pump is NOT available for use.

The VFD faulted while operating the pump.

Menu Navigation and Data Entry
Pressing the menu button will enter the main setup menu items. The system will ask for a password if enabled. Using the arrow buttons, navigate to the item desired, and press enter. Navigate with the arrows and enter the item of choice to display its value. Enter to change the value using the arrow buttons and again press the enter button to accept the new value, or press esc. to exit without saving. Press the esc., enter and arrow buttons as desired to move up, drill down, and navigate the screen as needed.

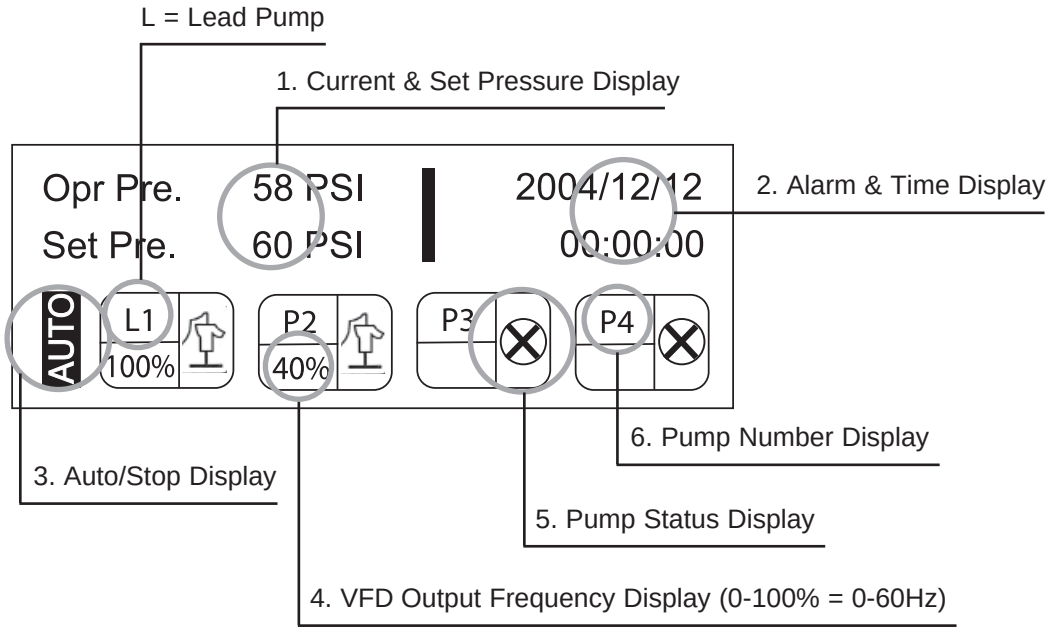
2.5 Description of LCD Screen

2.5.1 Opening Screen



Opening Screen: when the controller power is turned on, the opening screen will be displayed for 3 seconds.

2.5.2 Main Screen



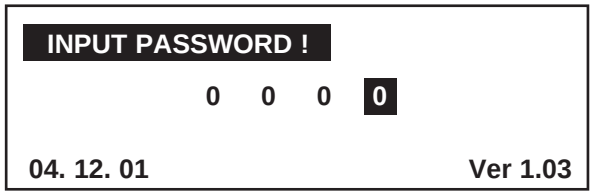
1. Opr. Pre = current discharge pressure & Set Pre = set pressure (Target pressure)
2. Alarm & Time Display: Display of the current time and alarm list if an alarm is active.
3. Auto/Stop Display: Display of the operating condition of the system.
“AUTO” – Is in AUTO if any of the HAND/OFF/AUTO selector switches in AUTO position (Input CN7)
“STOP” - is displayed if none of the HAND/OFF/AUTO selector switches are in AUTO position
4. VFD Output Frequency Display: Display of the output value of the VFD running.
The VFD output display can be configured in percentage (%) or in frequency (50Hz or 60Hz).
5. Pump Status Display: Idle, Running, VFD Fault, or Jockey.
6. Pump Number: Display of the total pumps and Lead pump and numbers.
The Lead pump is labeled “L”, the other pumps are labeled “P”.

Chapter 3

3.1 Security

The security system is programmed to prevent access by unauthorized persons to control setup without User Password.

<PASSWORD INPUT>



<Password Input Screen>

When you press the [MENU] button, the password pop-up window will appear as shown in the figure above. You must enter your user password "1234" to access the menu items screen.

- Set the password by using the Up/Down & Right/Left Key and press the Enter button.
- The password must consist of 4 numbers.
- The default User Password is 1234.

NOTE: After entering the password, access to the setup screen will be granted until the LCD backlight timer times out. The password will then need to be re-entered to access the setup screens. If you don't give any controls on the Setup Menu Screen, it will automatically return to the Main Screen. It is strongly recommended to change the password after the initial access. If you set the system control to factory default setting, the password is initialized to the default password "1234". **NOTE: The password feature is disabled by default.**

3.2 Details of Setup Menus

3.2.1 Date/Time Setup: Current Time Setup

Menus	Setup Menu	Contents	Input Range
DATE/TIME	YEAR	Current Year Display	0000 ~ 9999
	MONTH	Current Month Display	1 ~ 12
	DATE	Current Date Display	1 ~ 31
	DAY	Current Day Display	MONDAY ~ SUNDAY
	HOUR	Current Hour Display	0 ~ 23
	MINUTE	Current Minute Display	0 ~ 59
	SECOND	Current Second Display	0 ~ 59

The time and date does not change should you set the set system to factory default.

3.2.2 Pump Setup

Menus	Setup Menu	Contents	Input Range
PUMP SETUP	LEAD PUMP	Lead Pump Selection	1 ~ 4
	PUMP 1	Used, Not used or Jockey	Used, Not Used, Jockey
	PUMP 2	Used or Not Used	Used, Not Used
	PUMP 3	Used or Not Used	Used, Not Used
	PUMP 4	Used or Not Used	Used, Not Used

The lead pump must be set to a pump that is USED and not the Jockey pump.

If PUMP1 is set to JOCKEY, the Jockey pump will always start first and cannot be the LEAD PUMP. The jockey pump is not included in the lead lag sequencing. The jockey pump will operate alone unless the set pressure cannot be maintained. Then the lead pump and subsequent pumps will start based on lead/lag sequencing. The jockey pump will stop after the lead pump starts and a preset delay times out (JOCKEY STOP DELAY).

3.2.3 Pressure Setup

Menus	Setup Menu	Contents	Input Range
PRESSURE SETUP	SET PRESSURE	Target pressure for the pump system discharge	2 PSI ~ 650 PSI
	SET PRESSURE 2	To change the set pressure to this alternate value, a dry contact must close between G-COM and 018 on the CN8 terminals.	2 PSI ~ 650 PSI
	HIGH LIMIT ALARM	If the discharge pressure exceeds this value, the controller will shutdown the pumps after a delay.	3 PSI ~ 719 PSI
	LOW LIMIT ALARM	If the discharge pressure drops below this value, the contoller will shutdown the pumps after a delay.	1 PSI ~ 649 PSI
	START LEAD PRESSURE	If the set pressure is 60 PSI and start lead pressure at -3 PSI, the lead pump will start when the operating pressure drops below 57 PSI.	-65 PSI ~ 65 PSI
	START LAG PRESSURE	If the set pressure is 60 PSI and start lag pressure is -7 PSI the lag pump(s) will start when if lead pump is operating full speed (100% and the system pressure drops below 53 PSI.	-65 PSI ~ 65 PSI
	STOP LAG PRESSURE	If the set pressure is 60 PSI and the stop lag pressure is 3 PSI the lag pump will stop if it is operating at minimum speed (example 50%) and the current pressure is over 63 PSI.	0 PSI ~ 65 PSI

3.2.4 Control Setup

Menus	Setup Menu	Contents	Input Range
CONTROL SET UP	P	P Value Setup of PID (Proportional)	0 ~ 200
	I	I Value Setup of PID (Integral)	0 ~ 200
	D	D Value Setup of PID (Derivative)	0 ~ 200
	CYCLE TIME	Sampling time of PID Control	0 ~ 999 m.sec
	ALTERNATION	Shifts the lead to the next available pump in the sequence.	0 ~ 999 HOURS (set to 0 for lead. Change every cycle, set to 999 for no alternation)
	FRICTION	PSI offset allowance for friction loss	0 PSI ~ 900 PSI
	RUN DELAY	Delay time for pumping output to start	0 ~ 999 SECONDS
	STOP DELAY	Delay time for pumping output to stop	0 ~ 999 SECONDS
	JOCKEY STOP DELAY TIME	Delay time after the main pump starts	0 ~ 999 SECONDS
	OPERATION TYPE	Sets the operation type. VFD = multiple VFD control system (1 VFD for each pump.) 1VFD+ATL = Single VFD control system (combination of 1 VFD and starters)	VFD, 1VFD+ATL
	LOW SUCTION TMR	Delay time before stipping the pump due to low suction pressure	10 ~ 999 SECONDS
	LOW SUCTION RST	Method used to reset the low suction shut down valve	AUTO, MANUAL
	LOW SUCT RST TMR	When low scution rest is set to auto, this is the time the controller will wait before attempting to reset.	10 ~ 999 SECS (2.78 hrs)
	LOW PRESS STOP TIME	Delay time before stopping the pump due to low pressure fault.	10 ~ 999 SECONDS
	DEFAULT	All parameters are set to factory defaults (except data setup)	YES, NO

3.2.5 Sensor Setup

Menus	Setup Menu	Contents	Input Range
SENSOR SETUP	TRANSDUCER TYPE	Range Setup of Sensor	29 PSI ~ 720 PSI
	SENSOR ADJUST	Sensor Offset Value	-72 PSI ~ 72 PSI

3.2.6 VFD Setup

Menus	Setup Menu	Contents	Input Range
VFD	VFD STOP TIME	Time delay for when the last pump stops after the speed drops to the VFD minimum rate.	0 ~ 60 SECONDS
	VFD MINIMUM RATE	VFD minimum speed output	10 ~ 90%
	VFD STOP RATE	The last pump stops when its speed is less than this set value and the VFD STOP TIME is done.	20 ~ 90%
	VFD DISP. TYPE	Display the VFD output value on the main screen.	100%, 60Hz, 50Hz
	VFD AUTO RESET	Reset times after an alarm happened while the VFD was operating.	0 ~ 20
	PIPE FILL	Enable or disable the pipe fill function.	ON, OFF
	PIPE FILL RATE	The preset speed the pump will run on start up slowly fill the pipes. Runs for the PIPE FILL TIMER or the SET PRESSURE is reached.	10- 90% or VFD min speed
	PIPE FILL TIMER	The length of time the pump will run. If the set pressure is reached during this time, the system will switch to PID immediately.	5 ~ 600 SECONDS

3.2.7 Protect Setup

Menus	Setup Menu	Contents	Input Range
PROTECT	IDLE PREVENTION	When set to USED, if the lead pump has not ran for 10 days, the system will automatically run the lead pump at the minimum operating speed for 60 seconds. Then it will switch lead pump. The same process will be repeated if the succeeding lead pump does not run for 10 days etc.	USED, NOT USED
	FREEZE PREVENTION	When set to USED, the lead pump will automatically start the VFD minimum output for 30 seconds and then shift to the next pump when the temperature is under 32 deg. This will occur when all pumps are stopped for more than 30 seconds at the same time	USED, NOT USED
	PASSWORD USE	See password section for description	USED, NOT USED
	PASSWORD		0000 ~ 9999

3.2.8 System Setup

Menus	Setup Menu	Contents	Input Range
SYSTEM SET UP	RETURN MAIN SCREEN	Returns to the main screen after set time if user does not use any key controls	10 ~ 300
	LCD BACK LIGHT TIME	After the set time, LCD back light automatically turns off. This can be disabled by setting value to 999.	10 ~ 999
	DATA LOG	Sets the sampling rate for the Operation data log	10 ~ 999
	TEST CODE	Internal code to check the system.	0 ~ 9999
	RELAY OUTPUT 1-5 DIGITAL OUTPUT 6-13	Relay output 1-5 allows for up to 5A @ 250V Digital output is transistor out. High = 5V Low = 0V Available settings for outputs are: NOT USED, PUMPS STOPPED, PUMPING, GENERAL ALARM, LOW SUCTION, P1-P4 VFD RUN, P1-P4 ATL RUN, BUZZER, LOW PRESSURE, HIGH PRESSURE, VFD 1-4 FLT/HOA, SENSOR FAULT	
	LANGUAGE	Language selection	English/Espanol
	PRESS UNIT	Unit of measure for analog input	PSI/BAR

3.2.9 Communication Setup

Menus	Setup Menu	Contents	Input Range
COMM SETUP	RS232 TYPE	Select the type of communication	Not Used, MODEM, INTERNET
	BAUDRATE (232)		2400, 4800, 9600, 14400, 19200 38400, 57600, 76800, 115200
	RS485 TYPE	Not available for remote monitoring	Not Used, REMOTE
	BAUDRATE (485)		2400, 4800, 9600, 14400, 19200
	ADDRESS	Slave Address when you set the remote of RS485	0 ~ 31
	CODE	Characteristic numbers and communication code when RS232 control	0 ~ 999

3.2.10 Communication Setup

Menus	Setup Menu	Contents	Input Range
PROGRAM	SCHEDULE OPERATION	This function allows the set pressure to be adusted based on a schedle. If on certain days of the week, you wanted the set pressure to be different, you would set schedule operation to WEEKLY then set the pressures for the days of the week.	NOT USED, TIMELY, WEEKLY, MONTHLY
	00:00:00 ~ 00:00:00		
	TUESDAY		
	FEBRUARY		

3.3 Setup Menu Display & Input Method

Example for the Data Setup Change

DATE/TIME	**PUMP SET**	**PRESSURE**
CONTROL	**SENSOR**	**VFD**
PROTECT	**SYSTEM**	**PROGRAM**
COMM SET	**ALARMS**	**DATA LOG**

<Fig 1> Menu Setup Screen

DATE & TIME SETUP **(4.0/RUN)**

2005 **/ 12 / 22 [WED]**

11 : 00 : 00

<Fig 2> Data Setup Change Screen

DATE & TIME SETUP **(4.0/RUN)**

2005 / 12 / 22 **[WED]**

11 : 00 : 00

<Fig 3> Date Setup Change Screen

1. The display will change to <Fig 2> if you press the enter button after selecting the Date/Time on the Menu Setup <Fig 1>.

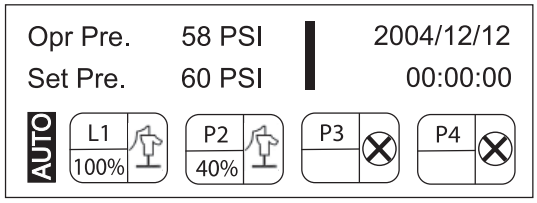
2. Moved to the set position which needs to be changed: Year/Month/Day/Week by Right & Left key. Press the Enter key and edit when flashing.

3. Change the value by using the Up/Down keys.

4. Save the changed value by pressing the Enter key.

5. Exit to the main screen by pressing the ESC key.

Example for the Pressure Setup Change



<Fig 1> Main Screen

Press the “MENU” button.

DATE/TIME	PUMP SET	PRESSURE
CONTROL	SENSOR	VFD
PROTECT	SYSTEM	PROGRAM
COMM SET	ALARMS	DATA LOG

<Fig 2> Menu Setup Screen

Use the UP/DOWN and RIGHT/LEFT keys to go to the Pressure Menu.

DATE/TIME	PUMP SET	PRESSURE
CONTROL	SENSOR	VFD
PROTECT	SYSTEM	PROGRAM
COMM SET	ALARMS	DATA LOG

<Fig 3> Pressure Setup Change Screen

Press “ENTER” button to open the Pressure Menu.

PRESSURE SETUP	(60.0/RUN)
SET PRESSURE	60 PSI
HIGH PRE. LIMIT	150 PSI
LOW PRE. LIMIT	20 PSI

<Fig 4> Pressure Setup Change Screen

Moved to the set position which needs to be changed using the UP/DOWN key. Press “ENTER” key.

PRESSURE SETUP	(60.0/RUN)
SET PRESSURE	6 PSI
HIGH PRE. LIMIT	150 PSI
LOW PRE. LIMIT	20 PSI

<Fig 5> Pressure Setup Change Screen

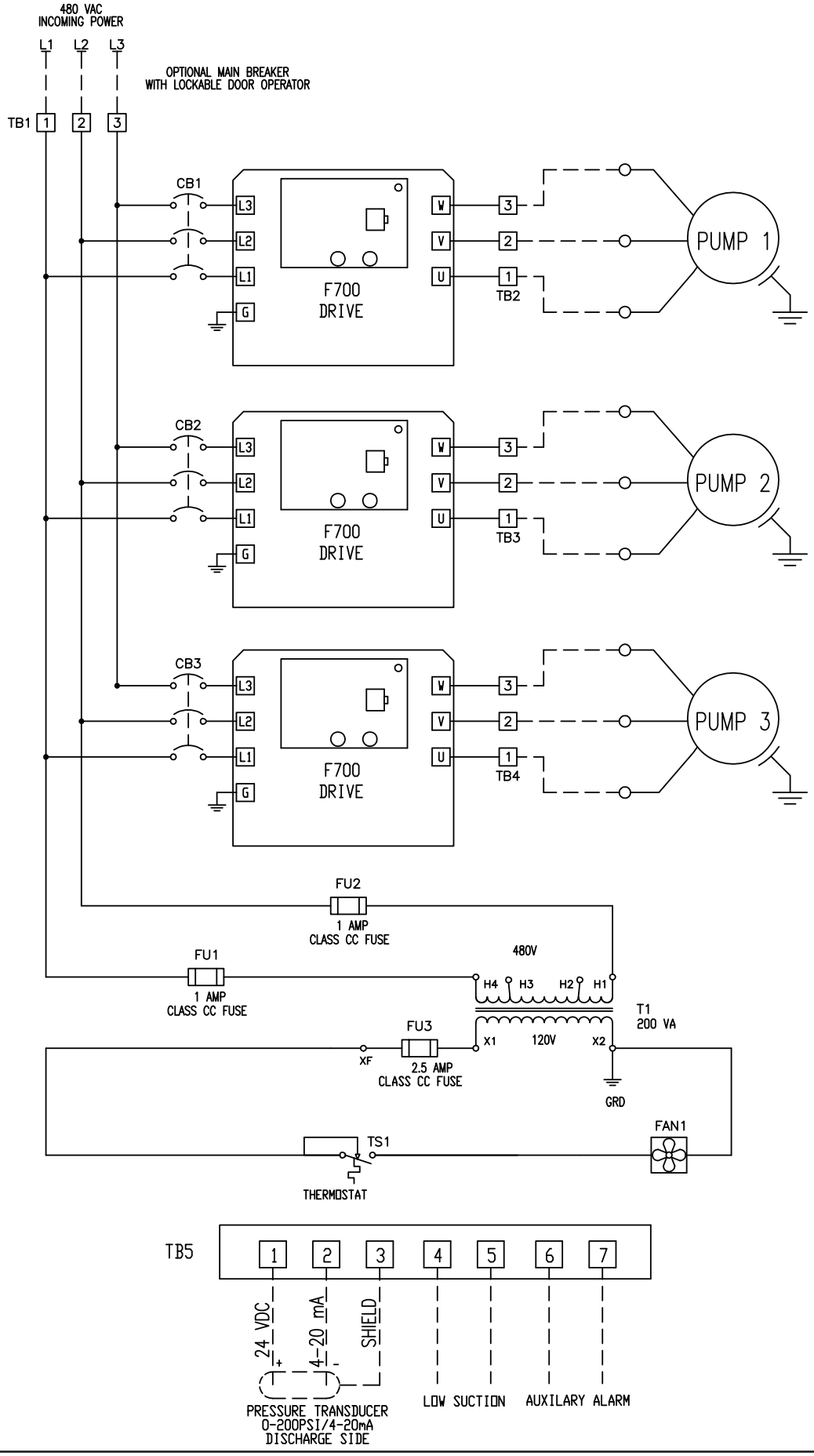
Use the UP/DOWN and RIGHT/LEFT keys to edit.

PRESSURE SETUP	(60.0/RUN)
SET PRESSURE	6 PSI
HIGH PRE. LIMIT	150 PSI
LOW PRE. LIMIT	20 PSI

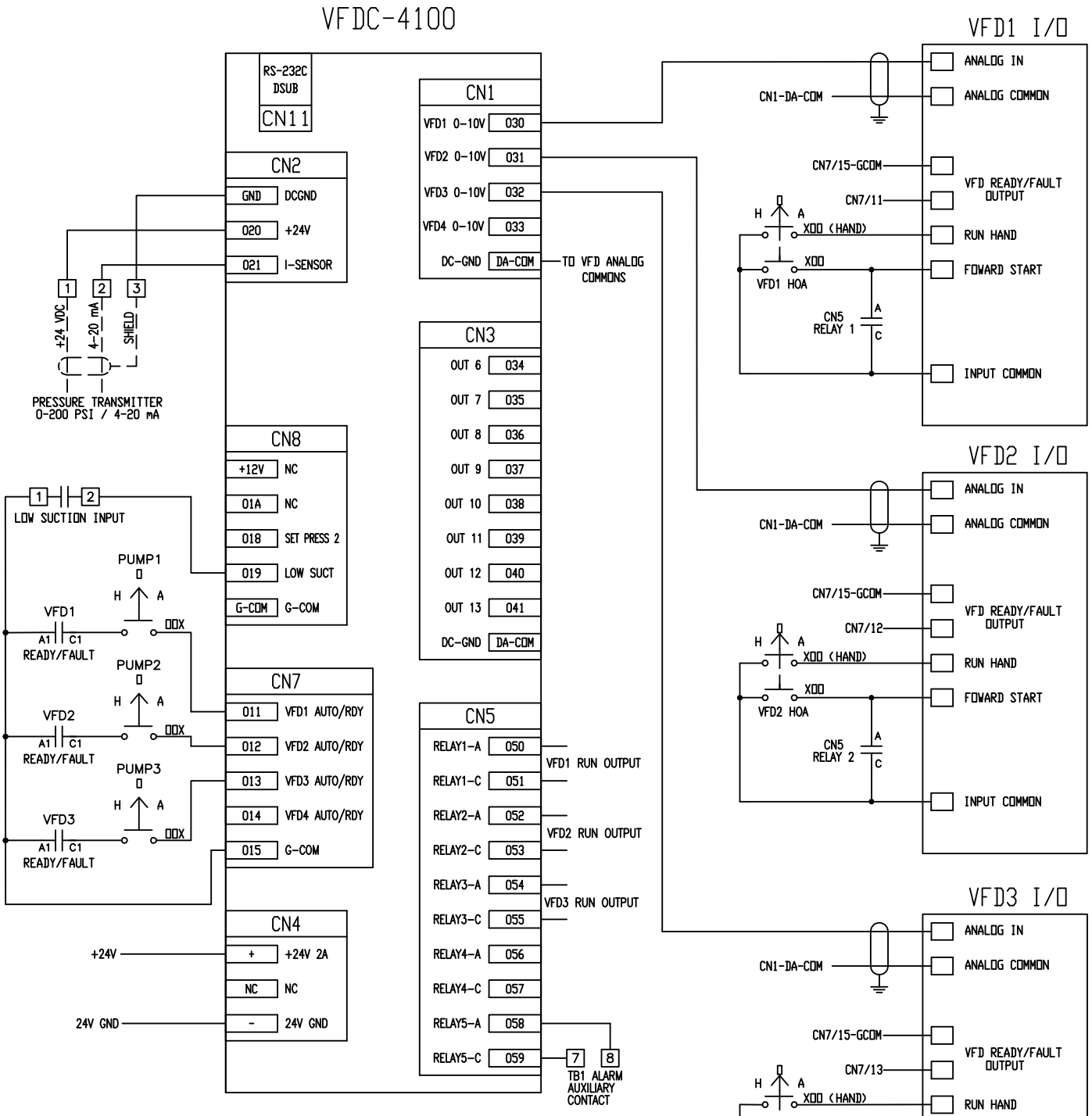
<Fig 6> Pressure Setup Change Screen

Save the changed value by pressing the Enter key.
Exit to the main screen by pressing the ESC key.

4.1 Typical Triplex VFD Power Circuit Schematic (OPER TYPE =VFD)



4.2 Typical Triplex Controller Circuit Schematic (OPER TYPE = VFD)



VFDC-4100 PARAMETERS CHANGED FROM DEFAULT VALUES

PUMP SET:
- P1 = USED
- P2 = USED
- P3 = USED

PRESSURE:
- SET PRESSURE = 60 PSI
- HIGH PRE. LIMIT = 95 PSI
- LOW PRE. LIMIT = 15 PSI
- START LEAD PRESS. = -3 PSI
- START LAG PRESS. = -7 PSI
- STOP LAG PRESS. = 3 PSI

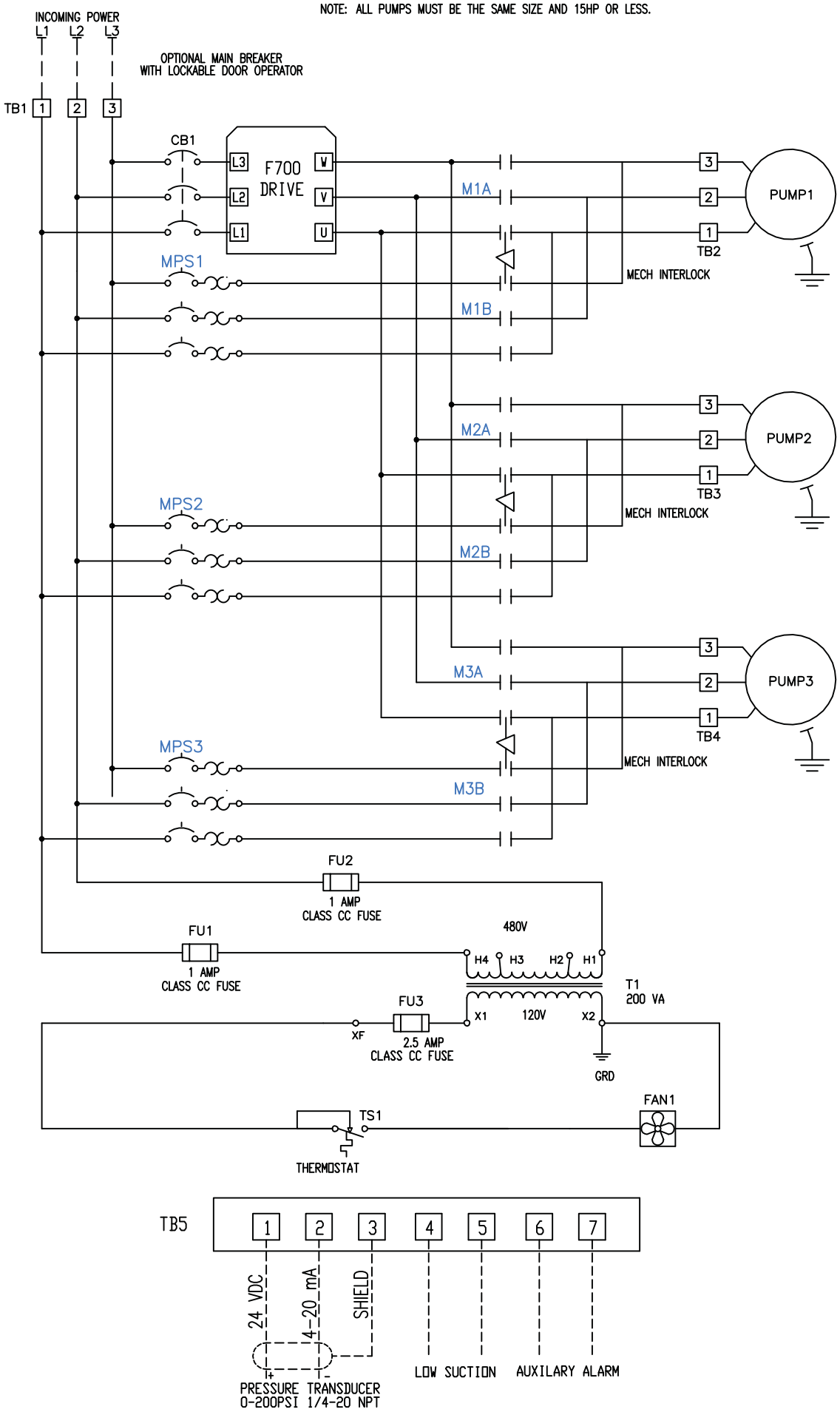
SENSOR:
- TRANS. TYPE = 200 PSI

SYSTEM:
- OUTPUT RELAY 1 = PUMP 1 RUN
- OUTPUT RELAY 2 = PUMP 2 RUN
- OUTPUT RELAY 3 = PUMP 3 RUN
- OUTPUT RELAY 5 = GENERAL ALARM

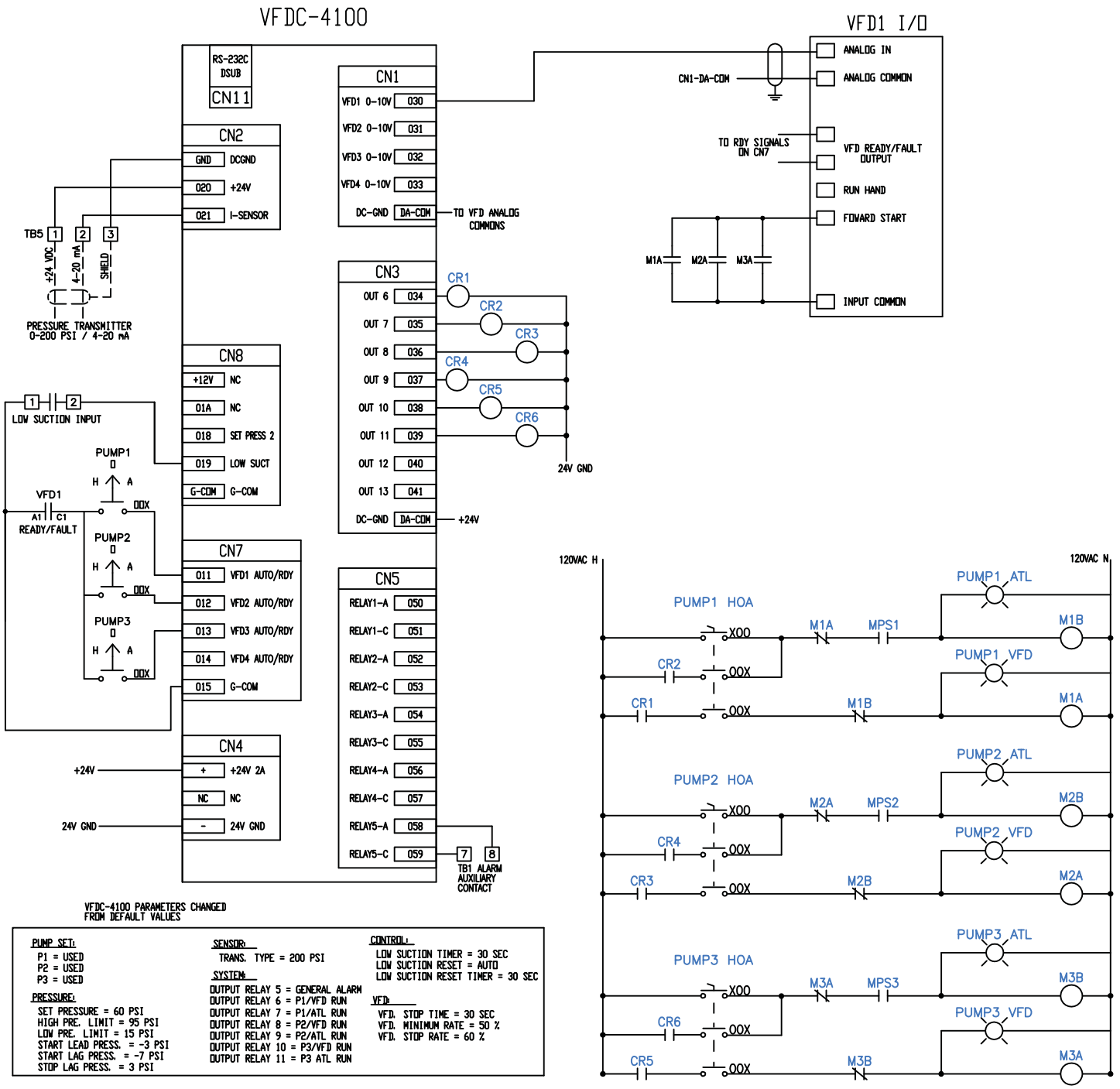
VFD:
- VFD. STOP TIME = 30 SEC
- VFD. MINIMUM RATE = 50 %
- VFD. STOP RATE = 60 %

CONTROL:
- LOW SUCTION TIMER = 30 SEC
- LOW SUCTION RESET = AUTO
- LOW SUCTION RESET TIMER = 30 SEC

4.3 Typical Triplex VFD Power Circuit Schematic (OPER TYPE = 1VFD+ATL)



4.4 Typical Triplex Contorller Circuit Schematic (OPER TYPE = 1VFD+ATL)



Chapter 5

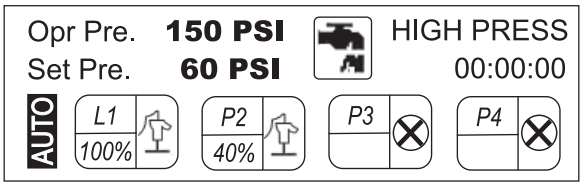
5.1 Troubleshooting

Troubles	Major Cause	Actions
The operating pressure does not increase after pump starts.	Pump air locked	Consult your mechanical contractor
	Check valve back flow defective	Consult your mechanical contractor
	Insufficient pump capacity	Consult your mechanical contractor
	Bad connection to the pressure transducer	Consult your mechanical contractor
	The infiltration of foreign object into the pump	Consult your mechanical contractor
	Broken coupling	Consult your mechanical contractor
	Pump reverse rotation	Consult your mechanical contractor
	The discharge valve closed	Consult your mechanical contractor
	Air infiltration into the discharge pipe	Consult your mechanical contractor
	Discharge pipe crack (low pressure alarm condition)	Consult your mechanical contractor
	Damage on the pressure transducer Incorrect VFD stop rate	Replace the pressure transducer Increase VFD stop rate
Pump does not stop.	Bad connection to the pressure transducer	Connect the pressure transducer hose
	Defective pressure transducer	Compare pressure gauge to transducer, replace if necessary
	Check valve back flow	Consult your mechanical contractor
Pump repeats start and stop too frequently.	Abnormal air pressure tank	Consult your mechanical contractor
	Insufficient pressure tank capacity	Consult your mechanical contractor
	Abnormal voltage	Check the voltage
Over current and trip while pump runs.	Defective motor	Consult your mechanical contractor
	The pump is broken	Consult your mechanical contractor
	The infiltration of foreign object into the pump	Consult your mechanical contractor
	Circuit breaker off	Turn on the circuit breaker
Pump does not start after turning on the power.	No water in the reservoir	Fill the reservoir with water
	The motor is out of order	Repair the motor or replace it
	Abnormal voltage	Check the voltage
	VFD tripped	Reset VFD
	The pressure transducer is out of order	Repair the pressure transducer or replace it
	Bad motor wiring	Check the motor wiring and correct it if required
Pump running out of sequence.	Bad panel control cable connection	Correct the cable connection
LCD display is not viewable.	Excessive noise	Turn off the power and turn on, or reset
	LCD defective	Replace LCD

Chapter 6

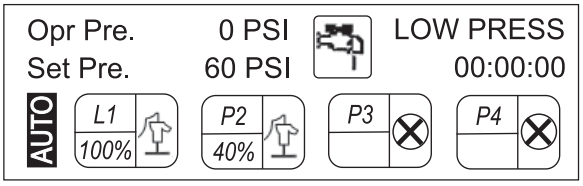
6.1 Fault Alarm Display & Corrective Action

6.1.1 High Pressure Alarm



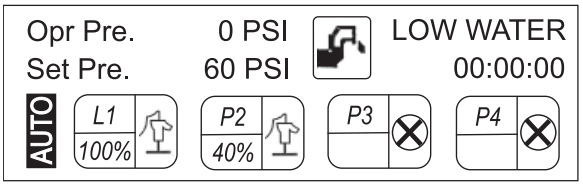
Cause: The discharge pressure was higher than the HIGH Limit Pressure while the system was operating.
Reset: Auto reset clear. The discharge pressure drops below the High Limit Pressure and the system has stopped.
Output: LCD Display/ERROR LED/BUZZER
Actions: Please check the pipe and system.

6.1.2 Low Pressure Alarm



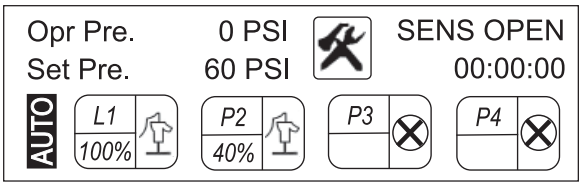
Cause: The discharge pressure was less than the Low Limit Pressure while the system was operating. Indicative of a broken pipe.
Reset: If the discharge pressure rises above Low Limit Pressure before the Low Pressure Alarm, the pumps will not stop. If not the pump stop and will require a manual reset.
Output: LCD Display/ERROR LED/BUZZER
Actions: Please check for broken pipes and leaks. The system will stop if the alarm is active for longer than the set time (refer to 3.2.4). Press RESET to clear this fault.

6.1.3 Low Water Level Alarm



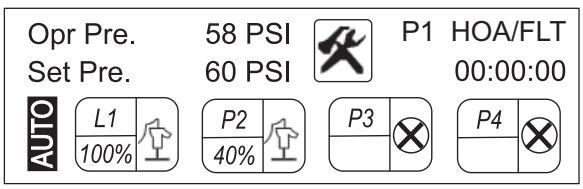
Cause: Low suction pressure was detected by a pressure switch (optional) on suction piping present while the system was operating.
Reset: If LOW SUCTION RST is set to MANUAL, the RESET button must be pressed to clear the alarm. If set to AUTO, the alarm will clear itself based on the LOW SUCTION RST TMR.
Output: LCD Display/ERROR LED/BUZZER
Actions: Please check the suction pressure, piping, low water level wiring and change the low water level sensor. The system will stop if the alarm is active for longer than the set time (refer to 3.2.4). Press RESET to clear. Low suction signal must not be preset to clear alarm 3.2.4). Press Cancel to reset and Run/Stop to run the system again.

6.1.4 Sensor Fail/Open Circuit



Cause: The pressure sensor has failed, shorted, or opened.
Reset: The sensor is normally operating.
Output: LCD Display/ERROR LED/BUZZER
Actions: Please check the connection to the pressure sensor and replace if necessary. Press Run/Stop to run the system after the sensor is replaced.

6.1.5 P1 HOA/VFD, P2 HOA/VFD etc.



Cause: HAND/OFF/AUTO (HOA) selector switch is not in the AUTO position or the VFD Error Signal was present while the system was operating.
Reset: Error signal was cleared after VFD reset and the system has stopped.
Output: LCD Display/ERROR LED/BUZZER
Actions: Please check that the HAND/OFF/AUTO switch is in the AUTO position, check the wiring to the controller input CN7, and VFD parameter

6.2 Alarm Data Screen

Alarm Data Screen View/Acknowledgement Method

The system is able to record total 32 data. Records and displays the alarm sequentially by Number, Date, Alarm Occur times and alarm type.

ALARM DATA	(0.0/RUN)
1. 04/12/15 14:16	4 SENS OPEN
2. 04/12/15 14:16	2 LOW PRESS
3. 04/12/15 14:16	1 LOW WAT ST ▼

UP/DOWN KEY: Scroll the list each 1 line.

6.3 Operation Data Log Screens and Run Times

To access the Operation Data (Data Log) or the Run Times, go to the Menu Setup screen.

DATE/TIME	PUMP SET	PRESSURE
CONTROL	SENSOR	VFD
PROTECT	SYSTEM	PROGRAM
COMM SET	ALARMS	DATA LOG

Use the UP/DOWN and RIGHT/LEFT keys to go to the Data Log Menu.

Menu Setup Screen

DATE/TIME	PUMP SET	PRESSURE
CONTROL	SENSOR	VFD
PROTECT	SYSTEM	PROGRAM
COMM SET	ALARMS	DATA LOG

Press “ENTER” button to open the Data Log Menu.

Use the ▲ or ▼ keys to select between OPERA DATA ▲▼ RUN TIME
“Enter” to display.

6.3.1 Operation Data Log Screen

It is able to record total 2000 data. Records and displays in the following format: Month/Date, Hour: Minute: Second, Current Pressure, Lead Pump, Current Output and Condition.

OPERA DATA			(0.0/RUN)	
12/24	13:24:08	4.0	1P	78%
12/24	13:29:39	4.0	1P	77%
12/24	13:32:39	4.0	1P	78%
12/24	13:43:39	4.0	1P	78%
12/24	13:42:21	0.0	1P	48%LoP
12/24	13:55:21	0.0	1P	40%RUN

UP/DOWN KEY: Scroll the list each 1 line. RIGHT/LEFT KEY: Scroll the list each 60 lines.

6.3.2 Records List

Records regularly while operating. Set the system when the system is operating.
Records regularly based on the Operation Data Interval set value.

"12/23 14:43:33 0.0 1P 0%"

Records when an alarm occurred.

"12/26 14:43:33	0.0	1P	0%Hip"	High Pressure Alarm
"12/23 14:43:33	0.0	1P	0%LoP"	Low Pressure Alarm
"12/23 14:43:33	0.0	1P	0%LoW"	Low Water Alarm
"12/23 14:43:33	0.0	1P	0%I1E"	VFD 1 Error
"12/23 14:43:33	0.0	1P	0%I2E"	VFD 2 Error
"12/23 14:43:33	0.0	1P	0%I3E"	VFD 3 Error
"12/23 14:43:33	0.0	1P	0%I4E"	VFD 4 Error
"12/23 14:43:33	0.0	1P	0%LPS"	Low Pressure Stop
"12/23 14:43:33	0.0	1P	0%Sop"	Sensor Open
"12/23 14:43:33	0.0	1P	0%Sap"	Sensor Shortage
"12/23 14:43:33	0.0	1P	0%LWS"	Low Water StopRecords when power is supplied.

Displays as "12/23 14:43:33 0.0 1P 0%Pun"

Records when the system operation starts.

Displays as "12/23 14:43:33 0.0 1P 0%RUN"

Records when the system operation stops.

Displays as "12/23 14:43:33 0.0 1P 0%STP"

1. RUN TIMES

OPERA DATA	(0.0/RUN)	
P1:	10 HOURS	42 MINS
P2:	10 HOURS	47 MINS
P3:	2 HOURS	41 MINS
P4:	0 HOURS	0 MINS

A record of each pump run time is logged on this screen.

ModBus Communication Functions & Address Code

Functions	Description	Address (Hex)	Scaling
SYSTEM ON	System Run	AD 10 70 0D 00 01 00 01 CH CL	
SYSTEM OFF	System Off	AD 10 70 0D 00 01 00 01 CH CL	
PRESSURE SETUP	1: Set Pressure	AD 10 82 01 00 01 00 SP CH CL	
	2: Over Pressure	AD 10 82 02 00 01 00 SP CH CL	
	3: Low Pressure	AD 10 82 03 00 01 00 SP CH CL	
	4: Run Pressure	AD 10 82 04 00 01 00 SP CH CL	
	5: Sub Run Pressure	AD 10 82 05 00 01 00 SP CH CL	
	6: Sub Stop Pressure	AD 10 82 06 00 01 00 SP CH CL	
LOW WATER	Low Water Error	AD 03 70 02 00 01 CH CL	0x80: low water, 0x00: no error
PUMP RUN SETUP	VFD1 Run Setup		0x01: VFD1 run setup
	VFD2 Run Setup	AD 03 70 0A 00 01 CH CL	0X02: VFD2 run setup
	VFD3 Run Setup		0x04: VFD3 run setup
	VFD4 Run Setup		0x08 VFD4 run setup
CURRENT PRESSURE	Current Pressure	AD 03 70 0B 00 01 CH CL	Current Pressure x 10
SET PRESSURE	Set Pressure	AD 03 70 0C 00 01 CH CL	Set Pressure x 10
RUN STATE	Run State	AD 03 70 0D 00 01 CH CL	0x41: start, 0x40: stop
ERROR FLAG	Error Flag	AD 03 70 0E 00 01 CH CL	0x001: high pressure
			0x002: low pressure
			0x004: VFD1 fault
			0x008: VFD2 fault
			0x010: VFD3 fault
			0x020: VFD4 fault
			0x040: low water alarm
			0x080: low pressure alarm
			0x090: sensor open
			0x100: sensor short
			0x200: low water stop
TIME SETUP	1: year	AD 03 80 01 ~ 7 00 01 CH CL	2xxxx
	2: month		xx
	3: day		xx
	4: hour		xx
	5: min		xx
	6: sec		xx
VFD SETUP	1: main pump	AD 03 81 01 ~ 5 00 01 CH CL	1 ~ 4
	2: pump 1		0: not used, 1: used
	3: pump 2		0: not used, 2: used
	4: pump 3		0: not used, 3: used
	5: pump 4		0: not used, 4: used
PRESSURE SETUP	1: set pressure	AD 03 82 01 ~ 6 00 01 CH CL	set pressure x 10
	2: over pressure		over pressure x 10
	3: low pressure		low pressure x 10
	4: run pressure		run pressure x 10
	5: sub run pressure		sub run pressure x 10
	6: sub stop pressure		sub stop pressure x 10

Functions	Description	Address (Hex)	Scaling
CONTROL SETUP	1: pvalue	AD 03 83 01 00 01 CH CL	pvalue x 10
	2: ivalue	AD 03 83 02 00 01 CH CL	ivalue x 10
	3: dvalue	AD 03 83 03 00 01 CH CL	dvalue x 10
	4: cycle time	AD 03 83 04 00 01 CH CL	cycle time
	5: shift	AD 03 83 05 00 01 CH CL	shift
	6: friction	AD 03 83 06 00 01 CH CL	friction x 10
	7: run delay	AD 03 83 07 00 01 CH CL	sec
	8: stop delay	AD 03 83 08 00 01 CH CL	sec
	9: oper type	AD 03 83 09 00 01 CH CL	x
	10: low water stop time	AD 03 83 0A 00 01 CH CL	sec
	11: low pressure stop time	AD 03 83 0B 00 01 CH CL	sec
SENSOR SETUP	1: trans type	AD 03 84 01 00 01 CH CL	trans type x 10
	2: sensor adjust	AD 03 84 02 00 01 CH CL	sensor adjust x 10
VFD SETUP	1: VFD stop time	AD 03 85 01 00 01 CH CL	%
	2: VFD minimum rate	AD 03 85 02 00 01 CH CL	%
	3: VFD stop rate	AD 03 85 03 00 01 CH CL	%
	4: VFD out value type	AD 03 85 04 00 01 CH CL	%
	5: VFD auto reset	AD 03 85 05 00 01 CH CL	%
PREVENTION SETUP	1: freeze prevention	AD 03 86 01 00 01 CH CL	0: no, 1: yes
	2: fix prevention	AD 03 86 02 00 01 CH CL	0: no, 1: yes
	3: password	AD 03 86 03 00 01 CH CL	1234 or 1004
ERROR COUNT	high pressure alarm count	AD 03 90 02 00 01 CH CL	no
	low pressure alarm count	AD 03 90 04 00 01 CH CL	no
	low water alarm count	AD 03 90 06 00 01 CH CL	no
	VFD1 alarm count	AD 03 90 08 00 01 CH CL	no
	VFD2 alarm count	AD 03 90 0A 00 01 CH CL	no
	VFD3 alarm count	AD 03 90 0C 00 01 CH CL	no
	VFD4 alarm count	AD 03 90 0E 00 01 CH CL	no
	VFD1~4 all alarm count	AD 03 90 10 00 01 CH CL	no

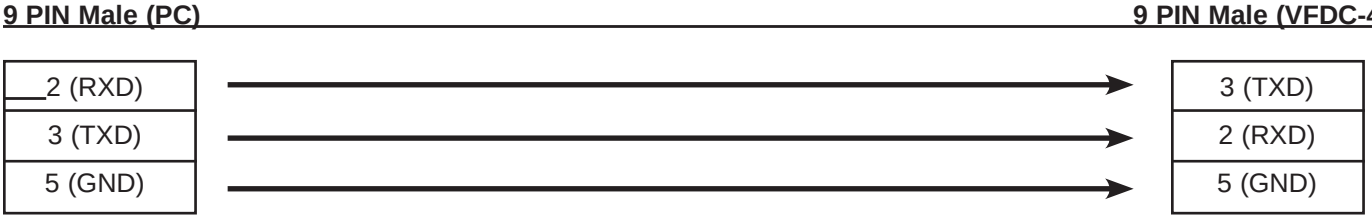
AD = ADDRESS

SP = Set Pressure x 10 (->Hex value change)

CH = CRC HIGH

CL = CRC LOW

Serial Cable for RS232 Communications with the VFDC-4100



ONE-YEAR LIMITED WARRANTY

SJE-RHOMBUS® warrants to the original consumer that this product shall be free of manufacturing defects for one year after the date of purchase. During that time period and subject to the conditions set forth below, SJE-RHOMBUS will repair or replace, for the original consumer, any component which proves to be defective due to defective materials or workmanship of SJE-RHOMBUS.

ELECTRICAL WIRING AND SERVICING OF THIS PRODUCT MUST BE PERFORMED BY A LICENSED ELECTRICIAN.

THIS WARRANTY DOES NOT APPLY: (A) to damage due to lightning or conditions beyond the control of SJE-RHOMBUS; (B) to defects or malfunctions resulting from failure to properly install, operate or maintain the unit; (C) to failures resulting from abuse, misuse, accident, or negligence; (D) to units which are not installed in accordance with applicable local codes, ordinances, or accepted trade practices, and (E) to units repaired and/or modified without prior authorization from SJE-RHOMBUS.

Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

TO OBTAIN WARRANTY SERVICE: The consumer shall assume all responsibility and expense for removal, reinstallation and freight of controller deemed defective. Any controller to be repaired or replaced under this warranty must be returned to SJE-RHOMBUS, or such place as designated by SJE-RHOMBUS.

ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS ARE LIMITED TO THE DURATION OF THIS WRITTEN WARRANTY. SJE-RHOMBUS SHALL NOT, IN ANY MANNER, BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES AS A RESULT OF A BREACH OF THIS WRITTEN WARRANTY OR ANY IMPLIED WARRANTY.

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NOTES:

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